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Journey from the forest of nanowires to the flatland of 2D materials

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Silicon whiskers were discovered in late 1950's and rediscovered in mid-90's. A single layer of graphite was discovered in 2004 (crowned with the 2010 Nobel prize) and followed by explosion of research on other 2D layered materials including MoS_2 and related transition metal dichalcogenides. Both breakthroughs led to exploration of fascinating properties of nanowires and atomically-thin layers, including quantum confinement, reduced density of structural defects, large active surface area and functional flexibility for electronics, photonics, sensors and energy applications. This seminar discusses our group research on fabrication, characterization and processing of semiconductor nanowires (NWs) into small-footprint chemical sensors, photodetectors and Li-ion batteries. The design of NW platforms spans from pick-n-place silicon and gallium nitride individual nanowire devices to vertically- and/or horizontally aligned periodic arrays towards wafer-scale device fabrication. From the forest of nanowires, the talk will proceed to the flatland of $MoTe_2$, $MoSe_2$ and other metal chalcogenide thin films, with the aim to benchmark their structural, optical and electrical properties and explore their potential application in beyond CMOS low-power, high-speed and flexible electronics and chem/bio-sensors.

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